When Sex Affects Syntax: Contextual Influences in Sentence Production

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This article addresses the question of whether accuracy in developing a syntactic frame for a to-be-uttered sentence is influenced by conceptual information beyond the initial assignment of grammatical functions on the basis of the speakers’ intentions, as predicted by the maximalist hypothesis we put forward in previous work (Vigliocco & Franck, 1999). In a series of four parallel experiments (in Italian and French) investigating gender agreement between a sentential subject and a predicative adjective, we found that conceptual information helps syntactic accuracy when congruent with syntactic information and hinders accuracy when incongruent. In a final experiment in Italian, potentially confounded linguistic factors were assessed and dismissed.© 2001 Academic Press

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Universally, languages use different words to refer to certain humans of different sex, for example man and woman; father and mother; husband and wife. According to typological classifications, the languages of the world tend to represent gender in the linguistic form either as a conceptual property or as a formal grammatical property (Corbett, 1991). English is an example of a language with an almost pure conceptual gender system in which gender marking is used for animate (mainly human) referents and in which there is a transparent relation between the sex of a referent and the gender of nouns and pronouns (with a few exceptions such as ship referred to as “she”). Romance languages are examples of languages with grammatical gender systems. All nouns are marked for gender (masculine or feminine). While there is a transparent relation between the gender of a noun and the sex of a referent for a set of nouns referring to humans and some animals, there is no conceptual basis for gender distinctions for nouns referring to objects and abstract entities or for a number of nouns referring to animate entities (Harris & Vincent, 1990).

Whether the gender of a noun is a conceptual or a grammatical property, it must be readily available during language production because this information is necessary for computing dependencies (agreement) between a noun and other words in a sentence such as determiners, adjectives, past participles, and pronouns. For example, establishing agreement between a noun and a predicative adjective in languages such as Italian and French follows a simple rule: If the noun is feminine, the adjective must be feminine. If the noun is masculine, the adjective must be masculine. This rule is the same for cases in which the gender of the noun is based

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on the sex of the referent (conceptual gender), as in *signore, monsieur* [gentleman] and *signora, madame* [lady], and when the gender of the noun is only a formal linguistic property without a relation to the sex of a referent, for example, *vittima, victime* [victim-fem] (grammatical gender) (see Vigliocco & Franck, 1999, for a detailed description of the gender systems of Italian and French).

Given that gender agreement follows the same rule regardless of whether the gender of the noun is conceptually motivated, and given that agreement is a paradigmatic example of syntactic dependency (Bock, 1995), it provides us with an excellent tool to assess a central issue in language production, namely whether conceptual information concerning the sex of a referent is used during syntactic encoding beyond the selection of a lexical element that corresponds to the intended referent. At a general level, gender agreement allows us to gain insight into how accuracy in building a syntactically well-formed utterance is achieved. Speakers are remarkably accurate at producing utterances. Bock (1991, p. 143) reports that in Deese’s (1984) corpus, spontaneous errors involving words and phonemes occurred at a rate of approximately 2.50 and 1.50 per 10,000 words, respectively. This level of accuracy is impressive if we consider that on average speakers produce 2–3 words per second (Levelt, 1989) and therefore there are ample opportunities for derailment.

**Accuracy in Production and the Role of Conceptual Information**

How is this level of accuracy achieved? It is generally assumed that producing a sentence entails multiple levels of processing (Bock, 1982; Garrett, 1976; Levelt, 1989). Syntactic processes operate at the level of *grammatical encoding* during which abstract lexical representations for words are retrieved and a hierarchically organized structure for the sentence is worked out and then linearized (see Vigliocco & Nicol, 1998, for a description). Gender agreement, a syntactic operation, is encoded during this stage. A subsequent phonological encoding stage determines the sound structure and the pronunciation codes for the sentence.

Within such a framework including multiple levels of integration, syntactic accuracy could be ensured by insulating the operations of the grammatical encoder from potentially interfering information from other levels (such as conceptual correlates and morphophonological features). In such a view, although grammatical encoding receives input from conceptual structures, mapping the conceptually salient dimensions into syntactic distinctions, phrasal integration processes (such as establishing long-distance dependencies) could operate autonomously. In Garrett’s (in press) words: “Semantic (conceptual) control is exercised in the initial stage of lexical and phrasal selection (i.e., lexical selection and grammatical functions assignment) but is not directly implicated in the mechanisms of phrasal integration.” In the case of gender, conceptual information about the sex of a referent is used in order to establish the gender of certain nouns (e.g., *amico, ami* [male friend-masc]/*amica, amie* [female friend-fem]) or to establish the word form to be used (e.g., for cases such as *marito, mari* [husband]/*moglie, femme* [wife]). Agreement with a predicative adjective, then, would be realized as a purely syntactic operation, irrespective of whether the gender of the noun is conceptually motivated or just a formal property of the noun (and therefore is oblivious to the conceptual information). We have labeled this the *minimalist* view (Vigliocco & Franck, 1999). With respect to gender agreement, this view is clearly parsimonious. It assumes that the same processes apply for nouns with and without conceptual connotations of sex, and it captures the fact that when the conceptual and the syntactic information are incongruent the agreement is grammatical rather than conceptual. A minimalist position is adopted by models of sentence production such as those of Garrett (1976, in press) and Levelt (1989), which embrace the principles of modularity of mind (Fodor, 1983).

A second possibility, which we have labeled the *maximalist* view (Vigliocco & Franck,
assumes that accuracy is achieved by taking advantage of information from other levels when available. Taking advantage of additional sources of information could be beneficial since it protects against information loss that can occur due to fluctuations in the system. Furthermore, conceptual information, if redundant, can strengthen the syntactic information. With respect to gender agreement, this view assumes that accuracy is achieved by using conceptual information beyond establishing the gender of a noun, or its word form. When present, this information is usually congruent with the syntactic information, thus providing an additional source. In this view, conceptual information permeates the agreement process, creating a potential advantage when there is a congruent mapping between the sex of the referent and the gender of the noun. However, it can create difficulties when the mapping between conceptual and syntactic information is incongruent. In this latter case, the two types of information may interfere and compete with each other, rendering encoding more difficult. This view is similar in spirit to other proposals that have been put forward to account for the influence of nonsyntactic factors in sentence comprehension, such as constraint satisfaction views (e.g., McDonald, Pearlmutter, & Seidenberg, 1994; Tanenhaus, Spivey-Knowlton, Eberhard & Sedivy, 1995) and the competition model (e.g., Bates & McWhinney, 1989).

Before discussing previous results that bear on the contrast between minimalist and maximalist views, a further clarification regarding the maximalist position is necessary. In this view we maintain a distinction between syntactic information (e.g., for nouns’ gender: masculine or feminine) and conceptual information (e.g., referring to a male or female entity). Furthermore, we distinguish between primary and secondary sources of information. An example from Romance languages may help clarify what we mean by primary and secondary sources of information. In subject–predicative adjective gender agreement, the syntactic information (gender of the noun) is considered the primary source of information because for this type of agreement relation, syntactic agreement is always acceptable. Conceptual information is considered a secondary source of information since, although it is taken into account by speakers (Vigliocco & Franck, 1999), conceptual agreement is not acceptable when the sex of a referent and the gender of the corresponding noun conflict. In contrast, syntactic information is not the primary source in subject–anaphoric pronoun agreement since both syntactic and conceptual agreement are acceptable, with conceptual agreement even preferred in some cases (Corbett, 1991). In subject–verb number agreement, syntactic information is most often the primary source. However, conceptual information can also sometimes constitute a primary source, as for collective nouns in British English. For this limited set of nouns, British English, in contrast with American English, sometimes allows use of conceptual information rather than syntactic information to compute number agreement (i.e., talking about the collectivity as distinct individuals as opposed to talking about the collectivity as a whole). As Eberhard (1999) pointed out, it is interesting that such dominance of conceptual information over grammatical information specifically occurs for collective nouns referring to humans (e.g., faculty and government), for which conceptual features may be more accessible than for nonhuman or inanimate referents.

The distinction between primary and secondary sources of information, which we have just drawn in descriptive terms, has a processing motivation. As discussed above, agreement is computed during grammatical encoding, a stage in which the unfolding representation is syntactic in nature, as suggested by slips of the tongue and other types of evidence. For example, Garrett (1980) observed that errors occurring during this process, that is, word exchanges that cross phrasal and clausal boundaries [as in examples (1) and (2)], do not show semantic/conceptual constraints. Instead, they show a strong grammatical class constraint:

(1) I have to fill up the gas with car

(intended: I have to fill up the car with gas; from Garrett (1975, p. 155)
(2) Older men choose to tend younger wives

Intended: Older men tend to choose younger wives; from Garrett, 1975, p. 155)

These observations, together with the finding of syntactic effects on agreement (e.g., Vigliocco & Nicol, 1998), support a processing account in which the syntactic specification is the primary information, while the conceptual specification is secondary. By examining whether and when a secondary source of information affects the processing of the primary source of information, predictions for the minimalist and the maximalist views can be contrasted.

Previous Studies Showing Conceptual Effects on Agreement

Previous work concerning both number and gender agreement has provided evidence in favor of the maximalist view. In studies concerning subject–verb agreement in number, conceptual effects have been shown for a number of languages. For example, Bock et al. (1999) showed that plural verbs were used in American English more often for collective nouns (e.g., jury) than for nouns referring to single individuals (e.g., juror). Eberhard (1999) and Vigliocco and colleagues (Vigliocco, Butterworth, & Garrett, 1996; Vigliocco, Butterworth, & Semenza, 1995; Vigliocco, Hartsuiker, Jarema, & Kolk, 1996) showed that plural verbs were used more often for so-called distributed noun phrases, such as (3), than for nondistributed noun phrases, such as (4):

(3) The label on the bottles
(4) The baby on the blankets

For nondistributed materials such as (4), the preferred interpretation implies only one baby sitting on a number of blankets. For distributed materials such as (3), the preferred interpretation entails many labels, each of which is attached to a different bottle. If the number of participants in the conceptual scene (one baby, many labels) is taken into account during phrasal construction, errors in the agreement of number between the subject and the verb should be more common for (3) than for (4). This is the general result reported in these different studies and languages. This finding is particularly interesting as the conceptual number (plural) of the head noun only arises when the entire complex noun phrase is considered, in contrast with the grammatical number (singular) of the subject noun phrase.

With respect to gender agreement, Vigliocco and Franck (1999) have assessed whether the presence of congruent conceptual information is advantageous compared to the situation in which only syntactic information is available. Consider examples (5) and (6) in Italian:

(5) La ragazza nel parco è rossa
The-fem girl-fem in-the-masc park-masc is red-fem (meaning: has red hair)

(6) La panchina nel parco è rossa
The-fem bench-fem in the-masc park-masc is red-fem

In both sentences, the predicative adjective rossa [red-fem] agrees in gender with the subject head noun. In (5), the gender of the noun ragazza [girl] is assigned on the basis of the sex of the referent: If the referent is female, then ragazza is to be used; if instead the referent is male, then ragazzo [boy] is to be used. In (6), the gender of the noun is an invariant lexical property, not conceptually motivated. The question concerned whether the sex of the referent is used beyond establishing the gender of the noun. If conceptual information is used in agreement, errors such as (7) should be less common than errors such as (8). This is what we found in both Italian and French:

(7) *La ragazza nel parco è rosso
The-fem girl-fem in-the-masc park-masc is red-masc

Although there may be differences in the degree to which different languages (as discussed in Vigliocco, Hartsuiker, Jarema, & Kolk, 1996) or different materials (as discussed in Eberhard, 1999) induce conceptual effects, the relevant finding is that some conceptual effects have been observed in all the investigated languages.
This previous study, therefore, supports the maximalist hypothesis by demonstrating that having congruent conceptual information is better than not having conceptual support. Vigliocco and Zilli (1999) extended the investigation to include two language-impaired speakers of Italian whose main difficulty was in the production of syntactic structures and markers (i.e., agrammatic patients). They were presented the same materials used in Vigliocco and Franck (1999). Although the patients produced significantly more gender agreement errors than age- and education-matched non-language-impaired speakers for nouns with grammatical gender, they did not differ from the non-language-impaired speakers for nouns with conceptual gender. This result was interpreted as indicating that the redundant and congruent conceptual information is used in the encoding by the patients.

In these previous studies concerning gender agreement, the effect of conceptual information was assessed by contrasting cases in which the gender of the noun was assigned on the basis of the speaker’s intentions (i.e., nouns with conceptual gender) to cases in which the gender is a formal property of the noun (i.e., nouns with grammatical gender). Such a contrast involves the use of different nouns with different properties. For the nouns with conceptual gender used in these studies, the same stem is used with two alternative suffixes, marking masculine (e.g., ragazz.o [boy]) and feminine (e.g., ragazz.a [girl]), in a manner similar to number assignment. The nouns with grammatical gender, instead, have only one form, masculine or feminine. It has been argued that this different linguistic status is an alternative interpretation of Vigliocco and Franck’s (1999) results (Schriefers & Jescheniak, 1999).

The studies concerning number agreement have shown that accuracy is jeopardized when conceptual and syntactic information mismatch, and the studies concerning gender agreement have shown better accuracy when the two types of information match. However, the strongest test for our maximalist approach is to simultaneously assess costs and benefits related to the presence of conflicting or congruent conceptual information relative to conditions in which such information is absent. In this article we report the results of such a test.

**Purpose and Overview of the Experiments**

Italian and French provide an excellent opportunity to assess the presence of beneficial and detrimental effects of conceptual information over syntactic information by investigating gender agreement between the subject of the sentence and a predicative adjective for subject nouns, such as *vittima, victime* [victim-fem] or *prodigio, prodige* [prodigy-masc]. These nouns, also referred to as “epicene nouns” (Marcantonio & Pretto, 1988), are functionally ambiguous in that they have a fixed grammatical gender but can refer to either a male or a female. For these words, agreement between a noun that is the subject of a sentence and a predicative adjective is with the grammatical gender of the noun, regardless of whether it refers to a male or female. By introducing a male or female actor coreferring to such nouns, we can contrast cases in which the conceptual information is congruent with the gender of the noun to cases in which the conceptual information is incongruent. Furthermore, by contrasting these cases to cases where no conceptual information is provided for the same words, we can assess whether the conceptual information induces a beneficial effect when congruent and a detrimental effect when incongruent, as predicted by the maximalist hypothesis.

We report five experiments (three in Italian and two in French). In all of the experiments speakers were required to repeat and complete a sentence preamble with a (provided) predicative adjective. In the first two experiments (one in Italian and one in French) speakers were presented with a sentential context as in (9), which they were asked to read silently:

(9a) Un camion ha investito Fabio/Fabiola che correva in bicicletta ascoltando musica

[A truck hit Fabio/Fabiola who was riding a bike while listening to music]
(9b) Un camion a percuté Fabien/Fabienne qui roulait à vélo et ne l’avait pas entendu

[A truck hit Fabien/Fabienne who was riding a bike and had not heard it]

Then they were presented with a sentence preamble such as (10) to complete:

(10a) La vittima dello scontro
(10b) La victime de l’accident

[The-fem victim-fem of-the-masc crash-masc]

Finally, they were presented with the two forms (masculine and feminine) of an adjective to be used in completing the sentential preamble (e.g., distratto/distratta [distracted-masc/distracted-fem] and sourd/sourde [deaf-masc/deaf-fem]).

In (10) the noun *vittima, victime* refers to a man (Fabio/Fabien) or to a woman (Fabiola/Fabienne). The sentential context introduces a main actor whose sex is congruent or incongruent with the gender of the noun (Fabiola/Fabienne represents a case of congruity, whereas Fabio/Fabien represents a case of incongruity). If the discourse information concerning the sex of the referent is taken into account in the encoding of subject-predicative adjective agreement, as predicted by the maximalist view, errors in gender agreement should be more common in the incongruent than the congruent condition. If the discourse information concerning the sex of the referent is taken into account in the encoding of subject-predicative adjective agreement, as predicted by the maximalist view, errors in gender agreement should be more common in the incongruent than the congruent condition. In contrast to previous studies (Vigliocco & Franck, 1999; Vigliocco & Zilli, 1999), the conceptual information here is a property of the discourse model and not a property of the noun itself. Therefore, an effect of the sex of the referent cannot be explained in terms of differences in the assignment of gender to the nouns (the same nouns are used in both conditions). The use of epicene nouns allows us to assess the role of conceptual information within items, since the same target noun is used with a congruent and an incongruent referent (e.g., vittima [victim]).

Experiments 1 and 2 contrast cases in which there is conceptual information, but it is incongruent with the grammatical gender of the noun. To anticipate the results, errors were significantly more common when the conceptual information was incongruent with the syntactic information than when the two types of information were congruent. Therefore, these results indicate that the conceptual information available to the encoding process is taken into account. However, they do not allow us to draw conclusions about whether the agreement process is hindered or helped by the additional conceptual information, since these experiments lack a neutral baseline.

Experiments 3 and 4 provide such a baseline. In these follow-up experiments, we used the same sentence preambles and the same task but no introductory sentential contexts. Without sentential context, speakers do not have conceptual information about the sex of the referent. The maximalist view makes the following two predictions with respect to comparing the results of Experiments 1 and 2 to the results of Experiments 3 and 4. First, errors in Experiments 3 and 4 should be more common than in Experiments 1 and 2 when the sex of the referent and the gender of the subject head noun are congruent. Second, errors in these experiments should be less common than in Experiments 1 and 2, when the sex of the referent and the gender of the subject head noun are incongruent.

Finally, Experiment 5 (Italian) tests alternative accounts of the results obtained in Experiments 1 and 2. In those experiments, we manipulated the proper name in the context sentence in order to have congruent and incongruent mappings between the sex of the referent and the gender of the subject noun. This is simultaneously a manipulation of the conceptual correlates of the name (sex of the referent) and the linguistic properties of the name (i.e., syntactic marking as masculine or feminine and morphophonological realization of syntactic marking). Our claim centers on the conceptual manipulation. However, the impact of the linguistic manipulations needs to be assessed. Experiment 5 aims at testing these alternative accounts using the same methodology as Experiments 1 and 2.
EXPERIMENTS 1 (ITALIAN) AND 2 (FRENCH)

In two parallel studies in Italian (Experiment 1) and French (Experiment 2), we manipulated the congruency between the sex of a referent introduced in a context sentence and the gender of the noun with which the adjective had to agree. We also manipulated the gender match/mismatch between the subject head noun and a local noun, embedded in a modifying noun phrase. A higher error rate for preambles in which the local noun had different gender (mismatch) than for preambles in which it had the same gender (match) has been previously reported by Vigliocco and Franck (1999). A higher incidence of errors for preambles in which the head and local noun mismatch is also a common finding in studies that have investigated number agreement between subject and verb (e.g., Bock & Miller, 1991; Bock & Eberhard, 1993; Vigliocco et al., 1995; Vigliocco, Butterworth, & Garrett, 1996). With respect to subject–verb agreement, the preferred interpretation of this mismatch effect is in terms of interference between the grammatical number of the subject head noun and the conflicting grammatical number of the local noun during the construction of a phrasal structure (Bock & Cutting, 1992; Vigliocco & Nicol, 1998). By orthogonally combining the manipulation of the sex of the referent and the manipulation of the gender match/mismatch between the subject head and the local noun we can assess the relative contribution of these two factors.

Method

Participants. Sixty-four undergraduate students from the Department of Psychology, University of Trieste, participated in Experiment 1 (Italian). Forty undergraduate students from the Department of Psychology, University of Louvain, participated in Experiment 2 (French). All participants were native Italian or French speakers who volunteered or received credits for their participation.

Materials. Materials for each experiment consisted of sentential contexts introducing either a male or female actor, sentence preambles composed of a subject head noun and a local noun embedded in a prepositional phrase, and adjectives to be used in the completions.

All head nouns used as experimental materials were epicene nouns (i.e., nouns with fixed grammatical gender that can refer to either a male or female referent). For these nouns, there may be biases in the language with respect to whether the nouns are used more commonly to refer to a man or to a woman. Thus we conducted a rating experiment with 16 additional Italian native speakers and 9 additional French native speakers who did not participate in any other part of the study. Raters were asked to indicate on a 7-point scale whether each word referred more often to a male (3) or female entity (−3). In Italian, the masculine nouns used in the experiments were more biased toward male referents \( (M = 1.75) \) than the feminine nouns were biased toward female referents \( [M = .09; t(30) = 4.93, p < .0001] \). In French, a similar asymmetry was found \( [ \text{for masculine nouns: } M = .74, \text{ for feminine nouns: } M = .40; t(30) = 2.87, p = .008] \). It was impossible to select only words that were judged as equally likely to refer to a man or to a woman because in both languages the number of epicene nouns is limited, so the obtained ratings were used as a covariate in statistical analyses performed in the production experiments. These biases can be considered as a form of stereotypical gender (Carreiras, Garnham, Oakhill, & Cain, 1996) in that they may reflect preferences in associating these words to referents of a given sex (therefore creating potentially congruent and incongruent mappings between the gender of the noun and the sex of the referent). Using these ratings as a covariate in the analyses partialed out the contribution of this factor.

The manipulated variables in the experiments were the sex of the referent introduced by the sentential context (male or female), the gender of the subject head noun (masculine or feminine), and the gender match or mismatch between the subject head noun and the local noun.

Sentential contexts were created that introduced a main actor and provided a plausible context for the experimental sentence preambles. Each head noun was used with two differ-
ent local nouns, one with matching gender and one with mismatching gender. All local nouns were nouns with grammatical gender, referring to inanimate entities. All the nouns used in the experiments were singular. The adjectives used in the experiments were all plausible predicates of the subject head nouns. Pairs of adjectives matched in number of syllables were used for each pair of preambles with the same head noun and different local noun. For each preamble, the two forms of the adjective (masculine and feminine) were presented one above the other. The position of each form (above or below) was counterbalanced across items.

It is important to note that Italian and French differ with respect to how well the word ending predicts gender. According to our estimate, obtained by considering 300 high- and 300 low-frequency morphologically simple nouns, the word ending predicts the gender of the noun in approximately 80% of Italian nouns. Words that end in “-o” are masculine and words that end in “-a” are feminine. The situation is quite different in French, where there is not such a systematic relation between word endings and gender in the spoken modality (although certain endings predict a given gender better than others; Tucker, Lambert, & Rigault, 1977). In Italian, all nouns used in the experiment were overtly marked for gender in the morphophonological form (i.e., they ended in “-o” for the masculine and “-a” for the feminine). In French, it was impossible to systematically control or manipulate this variable given the relatively small number of epicene nouns that could be used. On the basis of the norms published by Tucker et al. (1977), 13 of the 32 (41%) head nouns had a word ending which predicted the gender of the noun (i.e., more than 75% of the words with a given ending were all of the same gender), while the remaining 19 (59%) did not.

In Experiments 1 and 2, 32 experimental items and 22 filler items were used. In the fillers, all subject head nouns had conceptual gender (i.e., the noun unambiguously referred to either a male or female entity). In half it was masculine, and in half feminine. The sentential contexts for the filler items were created as for the experimental items. For the fillers, the sex of the actor introduced in the context and the gender of the head noun were always congruent. Four lists were created to represent the different experimental conditions. In each list, each condition was represented by four experimental items; filler items were the same across the lists. The organization of the filler and experimental items in each list was pseudorandom, with the only constraint being that each list started with two filler items. Examples of experimental materials are shown in Table 1.3

Procedure. Participants were tested individually. Materials were visually presented at the center of a computer screen. Trials started with the self-paced presentation of the sentential context that participants were instructed to read silently. A sentence preamble was presented for 900 ms and then adjectives were presented for 500 ms. The presentation times were the same as in other experiments (Vigliocco, Butterworth, & Garrett, 1996; Vigliocco & Franck, 1999) in which adjectives and sentence preambles were used and were sufficiently long to allow full comprehension of the materials. The participants’ task was to reproduce the sentence preamble and to complete it using the adjective in their completion. After completing a sentence, participants moved to the next item by pressing the spacebar in the majority of trials. However, after some filler trials (8/22) they were presented with a question concerning the sentential context and were instructed to respond. For example, in the Italian experiment, a filler trial was as follows: Sentential Context: “Per imbrogliare sul valore del terreno da stimare, Matteo si e’ fatto pagare la tangente” [In order to cheat on the value of the land, Matteo received a bribe]; Sentential Preamble: Il consulente del notaio” [The assistant of the notary]; Adjective: corrotto/corrotta” [corrupt]; and finally Context Question: “Perche’ Matteo ha preso la tangente?” [Why did Matteo receive a bribe?]. These questions were introduced to ensure that participants were paying attention to the sentential context.

3A full list of the materials used in the experiments can be found at http://www.idealibrary.com.
Completed sentences were recorded and then transcribed. Answers to the comprehension questions were also recorded and transcribed. Participants were highly accurate in their responses to these questions (99% correct in Italian, and 98% correct in French), and these responses were not further analyzed.

Scoring. Completed sentences were assigned to one of the following categories: correct responses when the participant correctly repeated and completed the preamble; agreement errors when the participant correctly repeated the preamble but produced an adjective that did not agree in gender with the subject; and miscellaneous responses when s/he failed to correctly repeat the preamble or the adjective.

Design and data analyses. Statistical analyses of agreement errors and miscellaneous responses (both with subjects and items as random factors) were performed. A subjects ANOVA included context (congruent vs incongruent); head noun gender (masculine vs feminine), and local noun (match vs mismatch) as experimental factors. An items ANCOVA included the same experimental factors as the subjects analysis and also took the gender bias ratings into account as a covariate. Context was manipulated within subjects and items. Gender of the head noun and local noun match/mismatch were manipulated within subjects and between items.

### TABLE 1
Example of Experimental Materials Used in Experiments 1 (Italian) and 2 (French)

<table>
<thead>
<tr>
<th>Language</th>
<th>Context</th>
<th>Sentence preambles</th>
<th>Adjectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Italian</strong></td>
<td>Anche se ha solo sei anni Un camion ha investito Fabio/Fabiola che correva bicicletta ascoltando musica</td>
<td>Masculine Subject Noun, Masculine Local Noun Il prodigio del conservatorio The prodigy of the music school Masculine Subject Noun, Masculine Local Noun Il prodigio dell’ accademia The prodigy of the academy</td>
<td>DOTATO/DOTATA Talented-masc/fem</td>
</tr>
<tr>
<td></td>
<td>Giovanni/Caterina dà concerti in tutto il mondo</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Although (he/she) is only six, Giovanni/Caterina performs concerts around the world</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
</tr>
<tr>
<td></td>
<td>La vittima della fatalità’</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A truck run over Fabio/Fabiola who was biking listening to music</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
</tr>
<tr>
<td></td>
<td>La vittima dello scontro</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
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<tr>
<td></td>
<td>The victim-fem of the crash</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
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<td></td>
<td>The victim-fem of the crash</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
</tr>
<tr>
<td><strong>French</strong></td>
<td>Les recherches de Roland/Rachel en biologie moléculaire comportent des enjeux considérables The research of Roland/Rachel in molecular biology involves very important stakes</td>
<td>Masculine Subject Noun, Masculine Local Noun Le génie du département The genius of the faculty Masculine Subject Noun, Masculine Local Noun Le génie de la faculté The genius of the department</td>
<td>PRUDENT/PRUDENTE Prudent-masc/fem</td>
</tr>
<tr>
<td></td>
<td>Un camion a percuté Fabien/Fabienne qui roulait à vélo et ne l’avait pas entendu A truck hit Fabien/Fabienne who was riding a bike and had not heard it</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td>SOURD/SOURDE Deaf-masc/fem</td>
</tr>
<tr>
<td></td>
<td>La victime de la collision The victim of the collision Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>La victime de l’accident The victim of the accident</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The victim-fem of the accident</td>
<td>Feminine Subject Noun, Feminine Local Noun</td>
<td></td>
</tr>
</tbody>
</table>
Results

In Italian, we obtained 1785 (87.1%) correct responses, 167 (8.2%) agreement errors, and 96 (4.7%) miscellaneous responses. In French, we found 1084 (84.7%) correct responses, 180 (14.0%) agreement errors, and 16 (1.3%) miscellaneous responses. The distributions of agreement errors and miscellaneous responses in the different experimental conditions are shown in Tables 2 (Italian) and 3 (French).

In both languages, agreement errors were most common for preambles introduced by incongruent contexts, as revealed by a significant main effect for context [for Italian, \( F(1, 63) = 41.467, p < .001; F(2, 1, 29) = 28.167, p < .001 \); for French \( F(1, 39) = 31.309, p < .001; F(2, 1, 29) = 46.992, p < .001 \)]. Errors were also more common for preambles with a feminine subject head noun [for Italian, \( F(1, 63) = 12.529, p = .001; F(2, 1, 29) = 8.733, p = .006 \); for French \( F(1, 39) = 38.154, p < .001; F(2, 1, 29) = 15.377, p < .001 \)]. In contrast to previous studies, we did not find a main effect of gender match/mismatch between the head and local noun [for Italian, \( F(1, 63) = 1.711, p = .196; F(2, 1, 29) = .114, p = .738 \); for French \( F(1, 39) = 2.746, F(2) < 1 \); French \( F(1, 39) = 1.987, p = .167; F(2, 1, 29) = 1.455, p = .238 \]. Context congruency and local noun mismatch did not interact [Italian \( F(1, 63) = 1.711, p = .196, \) all other \( F(S) < 1 \)]. The three-way interaction was significant in Italian by participants only [\( F(1, 63) = 6.192, p = .015; F(2, 1, 29) = .330, p = .570 \) and not significant in French (both \( F(S) < 1 \)).

As for the interactions, head noun gender did not interact with local noun match/mismatch [Italian \( F(1, 63) = 2.230, p = .140, \) all other \( F(S) < 1 \)], or with context congruency [Italian \( F(1, 63) = 2.746, F(2) < 1 \); French \( F(1, 39) = 1.987, p = .167; F(2, 1, 29) = 1.455, p = .238 \].

For the item covariate analysis in Italian, the gender bias was marginally correlated only with the frequency of errors [for main effect of bias, \( F(1, 63) = 3.826, p = .060 \); for all interaction terms involving bias, \( F(2) < 1 \)]. In French, only the interaction between bias, context congruency, and local noun mismatch was significant [\( F(2, 1, 29) = 4.841, p = .036 \); bias by local noun mismatch interaction, \( F(2, 1, 29) = 1.300, p = .264 \); all other bias terms, \( F(2) < 1 \)].

Miscellaneous responses were quite uncommon in both languages. In Italian, they were most common for preambles with feminine head nouns and masculine local nouns when the context was congruent. The analysis of variance by subjects revealed a main effect of the gender of the head noun [\( F(1, 63) = 4.3, p = .042 \], and a significant interaction between context and local noun [\( F(1, 63) = 8.2, p = .006 \]. In the analysis of covariance by items, no main effects or interactions were significant (main effect of head noun gender [\( F(2, 1, 29) = 2.4, p = .12 \); context by bias interaction [\( F(2, 1, 29) = 2.3, p = .13 \); all other \( F(S) < 1 \). In French, mis-

<table>
<thead>
<tr>
<th>TABLE 2. Numbers of Agreement Errors and Miscellaneous Responses (Percentages of All Responses) in Experiment 1 (Italian)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Context congruent</strong></td>
</tr>
<tr>
<td><strong>Local noun</strong></td>
</tr>
<tr>
<td><strong>Masculine</strong></td>
</tr>
<tr>
<td><strong>Feminine</strong></td>
</tr>
<tr>
<td><strong>Agreement errors</strong></td>
</tr>
<tr>
<td><strong>Match</strong></td>
</tr>
<tr>
<td><strong>Mismatch</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 3 Numbers of Agreement Errors and Miscellaneous Responses (Percentages in Parentheses) in Experiment 2 (French)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Context congruent</strong></td>
</tr>
<tr>
<td><strong>Local noun</strong></td>
</tr>
<tr>
<td><strong>Agreement errors</strong></td>
</tr>
<tr>
<td><strong>Match</strong></td>
</tr>
<tr>
<td><strong>Mismatch</strong></td>
</tr>
</tbody>
</table>

1.987, \( p = .167; F(2, 1, 29) = 1.455, p = .238 \).
cellaneous responses were somewhat more common for masculine head nouns and more common for incongruent than congruent contexts. In the analysis by subjects, the main effect of the gender of the head noun \( F(1, 39) = 8.4, p = .006 \) and the main effect of context \( F(1, 39) = 5, p = .03 \) were significant. No other main effect or interaction reached significance [head noun gender by context interaction, \( F(1, 39) = 2.6, p = .11 \); all other \( F \)s < 1]. In the co-variate analysis by items, only the main effect of context reached significance \( F(2, 29) = 5.1, p = .03 \). No other factors reached a significant level [head noun gender by context interaction, \( F(2, 29) = 2.8, p = .10 \); all other \( F \)s < 1].

**Discussion**

By manipulating the congruency between the sex of the referent and the gender of the noun, we obtained different error rates. In both languages, errors were most common when the sex of the referent and the gender of the noun were incongruent. This finding supports the maximalist view by indicating that both conceptual and syntactic information are taken into account during grammatical encoding. The results from Experiments 1 and 2, however, do not allow us to conclude that the conceptual information induces a cost when incongruent and a benefit when congruent, since the experiments lacked a neutral baseline. Experiments 3 and 4 were aimed at providing such a neutral baseline with which to compare the results from the current experiments.

Three other interesting findings emerged. First, the effect of gender mismatch between the head and local noun seemed to be overshadowed by an incongruent context, suggesting that our conceptual manipulation had a far greater impact than our syntactic manipulation when incongruency was introduced. The lack of a gender mismatch effect is at odds with previous experiments in which an effect of a mismatching local noun was found in different languages and for both number and gender agreement (e.g., Bock & Miller, 1991; Bock, Nicol, & Cutting, 1999; Vigliocco et al., 1995; Vigliocco & Franck, 1999). However, none of the previous studies introduced a discourse context. In our studies, the conceptual information given by the context may have played such a large role that it overshadowed the potential impact of mismatching syntactic information.

Second, as in previous experiments by Vigliocco and Franck (1999), errors in French (14.0% of all responses) were generally more common than in Italian (8.3%). Following Vigliocco and Franck (1999), this difference may result from differences between French and Italian in the degree of overt morphophonological marking of gender for nouns. As we already mentioned, while in French there is no clear relationship between the gender of a noun and its ending, especially in the spoken modality, the situation is very different in Italian. An effect of overt morphophonological marking of the head noun has been previously reported by Vigliocco and Zilli (1999) with both language-impaired and unimpaired speakers of Italian. In the present experiments, all head nouns used in Italian were transparently morphophonologically marked, while less than half of those used in French were. The presence of morphophonological information in the Italian experiments may have reduced the occurrence of errors in comparison with the French materials.

Third, in both languages we found an effect of the gender of the head noun, with more errors for feminine than masculine head nouns. In previous studies, such an effect was reported for French, but not Italian (Vigliocco & Franck, 1999). This finding is addressed in the General Discussion.

**EXPERIMENTS 3 (ITALIAN) AND 4 (FRENCH)**

Experiments 3 and 4 were aimed at providing a baseline in order to assess the costs and benefits of the contextual information observed in Experiments 1 and 2. We presented participants with the same sentence preambles used in the previous experiments, but no context was introduced. Without context, the only information available for agreement is the grammatical gender of the nouns. Comparing the congruent and
the incongruent conditions of Experiments 1 and 2 to the no-context conditions of Experiments 3 and 4 allows us to assess whether the presence of incongruent conceptual information is detrimental and whether the presence of congruent conceptual information is beneficial relative to the situation in which only the syntactic information is available. Because Experiments 3 and 4 use the same preambles as Experiments 1 and 2 with no context sentences, they also allow us to assess whether the lack of a gender mismatch effect in Experiments 1 and 2 is related to the presence of a context or, instead, to idiosyncratic features of the materials.

**Method**

**Participants.** Sixty-four undergraduate students from the Department of Psychology, University of Trieste, participated in Experiment 3 (Italian) and 60 undergraduate students from the Department of Psychology, University of Louvain, participated in Experiment 4 (French). They were all native Italian or French speakers who volunteered or received credits for their participation. None of them had taken part in Experiments 1 or 2.

**Materials.** Experimental materials consisted of the same sentence preambles and adjectives used in Experiments 1 and 2. Because no sentential contexts were used, only two lists were created combining the following manipulated variables: gender of the subject head noun (masculine vs feminine) and of the local noun (match vs mismatch). Each condition was represented by eight items.

**Procedure.** The procedure was the same as in the previous experiments, with the exception that no sentential contexts were presented, and therefore no comprehension questions were included on any of the filler trials. Participants were first presented with the sentence preamble and then the adjective. As in the previous experiments, their task was to produce a full sentence aloud using the preamble and the adjective.

**Scoring.** The scoring criteria were the same as in Experiments 1 and 2.

**Design and data analysis.** They were the same as used in the previous experiments, excluding the context factor.

**Results**

In Italian we obtained 1922 (93.9%) correct responses, 68 (3.3%) agreement errors, and 58 (2.8%) miscellaneous responses. In French we found 1717 (89.4%) correct responses, 137 (7.1%) agreement errors, and 66 (3.4%) miscellaneous responses. Table 4 shows the distribution of agreement errors and miscellaneous responses in the different experimental conditions in both languages.

In both languages, *agreement errors* were most common when the subject head noun and the local noun mismatched in gender, in contrast to the previous experiments [for Italian $F(1, 63) = 14.000, p < .001, F(2, 29) = 4.678, p = .039$; for French $F(1, 59) = 5.406, p = .024, F(2, 29) = 4.428, p = .044$]. As in the previous experiments, errors were more common for feminine than masculine head nouns [for Italian $F(1, 63) = 6.577, p = .013, F(2, 29) = 16.099, p < .001$; for French $F(1, 59) = 85.288, p < .001, F(2, 29) = 20.856, p < .001$]. Head noun gender and local noun mismatch did not interact (all $Fs < 1$), and for the item covariate terms, only the bias itself was significant in Italian [$F(1, 29) = 8.219, p = .008$; the bias did not interact with local noun mismatch, $F(1, 29) = 1.913, p = .177$]. In French, neither the bias nor the bias by local noun mismatch interaction were significant (both $Fs < 1$).

**Table 4**

Numbers of Agreement Errors and Miscellaneous Responses (Percentages in parentheses) in Experiments 3 (Italian) and 4 (French)

<table>
<thead>
<tr>
<th>Local noun head noun</th>
<th>Experiment 3 (Italian)</th>
<th>Experiment 4 (French)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Masculine</td>
<td>Feminine</td>
</tr>
<tr>
<td>Agreement errors</td>
<td>3 (1)</td>
<td>13 (2)</td>
</tr>
<tr>
<td>Mismatch</td>
<td>20 (4)</td>
<td>32 (6)</td>
</tr>
<tr>
<td>Miscellaneous responses</td>
<td>14 (3)</td>
<td>14 (3)</td>
</tr>
<tr>
<td></td>
<td>13 (2)</td>
<td>15 (3)</td>
</tr>
</tbody>
</table>
In the analysis of miscellaneous responses, no main effect or interaction was significant either in Italian or in French (all $F_s < 2; p > .15$).

Discussion

These two experiments showed a gender mismatch effect. When no biasing context was presented, errors were modulated by the presence of matching or mismatching gender information in the subject noun phrase. This finding is consistent with previous studies regarding number and gender agreement (e.g., Bock, 1995; Vigliocco & Franck, 1999). It appears then that the lack of such an effect in Experiments 1 and 2 is due to the greater impact of conceptual information compared to syntactic information, which is particularly plausible because of the magnitude of the context effect in our previous experiments. As in the previous experiments, agreement errors were more common in French (7.1%) than in Italian (3.3%) and also more common for feminine than masculine nouns.

Comparison of context and no-context experiments. Overall, errors in Experiments 3 and 4 (no-context) were less common than in Experiments 1 and 2 when the context was incongruent with the gender of the subject head noun (3.3% vs 14.7%, in Italian and 7.1% vs 21.7% in French). Errors in Experiments 3 and 4 were also more common than in Experiments 1 and 2 when the context was congruent with the gender of the head noun (2.3% vs 3.3% in Italian; and 6.5% vs 7.1% in French). The differences in overall error proportions between the context congruent vs no-context conditions and between the context-incongruent vs no-context condition were assessed using nonparametric tests. In Italian, the difference between the context-congruent condition (Experiment 1) and the no-context condition (Experiment 3) was significant by subjects (two sample Wilcoxon rank sum test) and by items (Wilcoxon signed rank test) (by subjects: $W = 3793.5, p = .04$; by items: $z = 3.3, p = .001$). The difference between the context-incongruent condition (Experiment 1) and the no-context condition (Experiment 3) was also significant by subjects and items ($W = 5055.5, p < .0001; z = 4.1, p < .0001$). In French, the difference between the context-congruent condition (Experiment 2) and the no-context condition (Experiment 4) was significant by subjects but not by items ($W = 3328, p = .016; z = 1.3, p = .19$). The difference between the context-incongruent condition (Experiment 2) and the no-context condition (Experiment 4) was significant by both subjects and items ($W = 2332, p < .0001; z = 2.8, p = .005$). Figure 1 shows the error proportions for both languages in the different experimental conditions.

Therefore, it appears that having an incongruent context hurts performance, whereas having a congruent context has some benefits. These costs and benefits, however, are not symmetrical, in that the cost associated with incongruent referents is far greater than the benefit associated with congruent referents. Why? One possibility is that when the gender of the noun and the sex of the referent are congruent, the additional conceptual information globally strengthens the syntactic information. Such redundancy would mainly be at play when the syntactic information is lost. In contrast, when the gender of the noun and the sex of the referent are incongruent, conceptual information would not only be used in case of a syntactic loss but also exerts a strong interfering effect on the agreement processing.

A second possibility is that speakers in the no-context experiments developed a discourse model in which the referent was either a man or

![FIG. 1. Percentage of agreement errors in Italian and French for the context congruent (Experiments 1 and 2), no context (Experiments 3 and 4), and context incongruent (Experiments 1 and 2) conditions.](image-url)
a woman depending on the grammatical gender of the noun. If participants develop discourse models in which the main actor’s sex is constrained by the grammatical gender of the noun, then the no-context condition becomes similar to the condition of congruence. Along these lines, Cacciari, Carreiras, and Barbonini-Cionini (1997) found that when confronted with epicene nouns, Italian readers use both the syntactic and conceptual information about the sex of a referent in building a discourse model for the sentence.

To this point, we have provided evidence that information given by a context affects agreement processes. However, before concluding that it is the conceptual information introduced by the context that affects phrasal integration, we need to address potential confounds. In Experiments 1 and 2, the context introduced a congruent or incongruent referent. Our manipulation of congruency and incongruency between the sex of the referent and the gender of the subject noun was realized by introducing proper names in the context sentences. Proper names carry conceptual information (they can refer to men or women), but they also carry syntactic information (they are masculine or feminine nouns) and morphophonological information (the noun’s ending can be related to gender in predictable ways). Experiment 5 was designed to assess the role of these two types of information in the performance of the sentence completion task.

EXPERIMENT 5 (ITALIAN)

To this point, the same context effects have been reported for Italian and French, and there are no a priori reasons to expect that Italian and French would show different effects for the current manipulations. We thus restricted the test of syntactic and morphophonological influences to Italian. We chose Italian for this final experiment because it allows for a simpler and more clear-cut manipulation of morphophonological marking than French, as previously discussed.

Two sets of items were built that both consisted of experimental sentence preambles introduced by context sentences.

In the first set, the contexts introduced inanimate referents. Therefore, the grammatical gender of the coreferring subject noun did not have conceptual correlates. Such a manipulation allows us to assess the role of syntactic congruence, as no conceptual information is involved. If the results of Experiments 1 and 2 are due exclusively to the conceptual correlates of the proper names, as we argue, we should not find any difference in the error rates for congruent and incongruent conditions for inanimate items. However, if the difference between congruent and incongruent contexts we found in Experiments 1 and 2 is due to the syntactic congruence between the proper name and the subject noun, we should find more errors when the noun in the context and the subject noun mismatch than when they match. Note also that syntactic congruence might have contributed to the effects we reported for Experiments 1 and 2 without being the only determining factor. In this case, we should find that agreement errors are more common for the incongruent inanimate items than the congruent inanimate items, but the difference between these two conditions for the inanimate items should still be less than the difference when both syntactic and conceptual information are present.

The second set of items comprised modified versions of the items used in Experiment 1. Proper names were changed in order to manipulate their morphophonological marking. They were either marked (i.e., ending in -o for a male name and ending in -a for a female name) or unmarked (i.e., ending in -e for both male and female names). By manipulating the morphophonological marking of the proper name we can assess the role of this information in addition to the conceptual and syntactic information it carries.

Method

Participants. Twenty-eight undergraduate students from the Department of Psychology, University of Trieste, volunteered to participate in the experiment.

Materials. As for Experiments 1 and 2, materials consisted of sentential contexts, sentence preambles and adjectives. The first set of items (called inanimate items) consisted of sixteen items in which the noun introduced in the con-
text and the coreferring subject head noun both referred to inanimate entities and that were congruent or incongruent in gender. In all experimental preambles, the local noun always mismatched in gender with the head noun. All subject head nouns were singular. The manipulated variables were (a) context (congruent vs incongruent) and (b) head noun gender (masculine vs feminine). Items in the different conditions were created as variants of the same materials. That is, for a given head noun, two context sentences were created in which the coreferring noun was masculine in one context sentence and feminine in the other. For each sentential context, two preambles were created, one with a masculine head noun and one with a feminine head noun. Examples of these inanimate items are shown in Table 5.

The second set of items (called animate items) were the same 32 items used in Experiment 1 except that the proper names were modified. Half of the names were transparently marked for gender either referring to a man (e.g., Gregorio) or a woman (e.g., Anna); the other half were ambiguously marked, although they referred unambiguously to either a man (e.g., Felice) or a woman (e.g., Alice). For these items, the manipulated variables were (a) context (congruent vs incongruent), (b) gender of the subject head noun (masculine vs feminine), and (c) morphophonological marking of the proper name (marked vs ambiguous).

Four lists were created, each of which contained 32 animate items; 16 inanimate items; and 12 filler items (a subset of the fillers used in Experiment 2). There were four inanimate and four animate items per condition in each list.

Procedure. The procedure was the same as in Experiment 1.

Scoring. The scoring criteria were the same as in Experiment 1.

Design and data analyses. Statistical analyses of agreement errors and miscellaneous responses (both with subjects and items as random factors) were performed separately for the inanimate and for the animate items. For the inanimate items, ANOVAs included context (congruent vs incongruent) and gender of the head noun (masculine vs feminine) as experimental factors. The gender of the head noun was manipulated within subjects and between items while context was manipulated within subjects and items. For the animate items, an ANOVA was performed with subjects as a random factor, while (as in Experiment 1) an ANCOVA was performed with items as a random factor, including the bias ratings as a covariate. In both analyses, the experimental factors were context (congruent vs incongruent), head noun gender (masculine vs feminine), and morphophonological marking of the proper name (marked vs ambiguous). Context and morphophonological marking were manipulated within subjects and items. Gender of the head noun was manipulated within subjects and between items.

Results

For the inanimate items, we found 404 (90.2%) correct responses, 15 (3.3%) agreement errors, and 29 (6.5%) miscellaneous responses. For the animate items we obtained 800 (89.3%) correct responses, 44 (4.9%) agreement errors, and 52 (5.8%) miscellaneous responses. Table 6 shows the distribution of agreement errors and miscellaneous responses for the animate and inanimate items in the different experimental conditions.

---

TABLE 5
Example of Experimental Materials Used in Experiment 5

<table>
<thead>
<tr>
<th>Context</th>
<th>Sentence preambles</th>
<th>Adjective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Il progetto del governo sorprese tutto il paese</td>
<td>Il decreto sulla droga</td>
<td>CONSERVATORE/CONSERVATRICE</td>
</tr>
<tr>
<td>The project-masc by the government surprised the whole country</td>
<td>The decree concerning the drug-fem</td>
<td>Conservative-masc/fem</td>
</tr>
<tr>
<td>La scelta del governo sorprese tutto il paese</td>
<td>The law concerning employment-masc</td>
<td></td>
</tr>
<tr>
<td>The-fem choice-fem by the government surprised the whole country</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
For the inanimate items, agreement errors were similarly common for preambles introduced by a congruent or an incongruent context (eight errors in the congruent and seven in the incongruent condition). Also errors were equally common for masculine and feminine head nouns. In the analysis of variance; no main effects or interactions achieved significance (all $F_s, 2, p > .15$). Miscellaneous responses also were equally common across conditions. In the analysis of variance no main effect or interaction was significant (all $F_s, 2, p > .15$).

For the animate items, we replicated the results reported in Experiment 1 with respect to the effect of context, while we failed to replicate the effect of the head noun gender. Importantly, we did not find any effect of morphophonological marking of the proper name introduced in the context (22 errors in the marked and 22 errors in the ambiguous condition). Agreement errors were more common when the context introduced an incongruent referent than when it introduced a congruent referent [$F(1, 27) = 21.77, p < .001; F(2, 29) = 10.75, p = .003$]. The main effect of the head noun gender was not significant by subjects [$F(1, 27) = 1.84, p = .18$] and marginally significant in the items ANCOVA [$F(2, 29) = 4.1, p = .052$]. No other main effect or interaction was significant (all $F_s < 1$). In the analysis of miscellaneous responses, the interaction between context and marking was significant by subjects [$F(1, 27) = 7.7, p = .01$], but not by items [$F(2, 27) = 3.2, p = .08$].

Vigliocco and Franck (1999) also performed a comparison between items to assess whether errors were less common for nouns with conceptual gender than for nouns with grammatical gender. In those experiments, the nouns were matched for frequency and number of syllables and nouns with conceptual and grammatical gender were paired in preambles with the same local nouns. In the current experiment, none of these differences were controlled, since the main purpose of the study was to assess the contribution of syntactic and morphophonological marking to the conceptual effects.

<table>
<thead>
<tr>
<th>TABLE 6</th>
<th>Numbers of Agreement Errors and Miscellaneous Responses (Percentages in Parentheses) in Experiment 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreement context</td>
<td>Miscellaneous responses context</td>
</tr>
<tr>
<td>Congruent</td>
<td>Incongruent</td>
</tr>
<tr>
<td>Inanimate items</td>
<td></td>
</tr>
<tr>
<td>Masculine head noun</td>
<td>4 (3)</td>
</tr>
<tr>
<td>Feminine head noun</td>
<td>4 (3)</td>
</tr>
<tr>
<td>Animate Items</td>
<td></td>
</tr>
<tr>
<td>Masculine head noun</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Feminine head noun</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Animate Items</td>
<td></td>
</tr>
<tr>
<td>Masculine head noun</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Feminine head noun</td>
<td>2 (2)</td>
</tr>
</tbody>
</table>
parison between context congruent animate items and inanimate items was only marginally significant ($W = 1.8, p = .07$), while the comparison between context incongruent animate items and inanimate items was significant ($z = 3.09, p = .002$).

**Discussion**

We failed to observe an effect of syntactic congruence between the subject head noun and a coreferring noun for the inanimate items, while a strong congruence effect was found for the animate items. This finding strongly indicates that syntactic congruence is not the primary cause of the effect for animate items. In addition, we failed to observe an effect of the morphophonological marking of the proper name introduced in the context for the animate items for the agreement errors. This finding indicates that morphophonological cues to gender per se also cannot account for the effect of context we found. Similar results were obtained in a post hoc correlation analysis we conducted in French. For each proper name used in Experiment 2, we computed the predictability of the word ending using the norms provided by Tucker et al. (1977). We then computed the correlation between these predictability values and the number of agreement errors for each item in the context incongruent condition and in the context congruent condition. In both cases, the correlation was not significant [$r(30) = .075, p < .005$ for the context incongruent condition; $r(30) = -.039, p < .005$ for the context congruent condition].

This is not to say that morphophonological information is never taken into account in computing agreement. The results obtained by Vigliocco and Zilli (1999; see also Vigliocco et al., 1995, for number agreement between the subject and the verb), in fact, indicate that whether the subject head noun is transparently marked for gender affects the likelihood of subject–predicative adjective agreement errors.

Vigliocco and Zilli (1999) found that agreement errors were more common when subject head nouns were ambiguously marked for gender in their endings than when they were unambiguously marked. Such a manipulation, however, is very different from the one we used in the current experiment. In the present experiment, we manipulated the morphophonological realization of the coreferring noun (hence a part of the discourse, not one of the agreeing elements). We found that such a manipulation does not affect the processes implicated in building a discourse model that guides production, at least as far as agreement is concerned.

These different lines of evidence allow us to conclude that the context effect we reported in Experiments 1 and 2 is a conceptual effect rather than a syntactic or a morphophonological effect.

For the animate items, in contrast to Experiment 1, we failed to observe a reliable effect of the gender of the subject head noun, with more errors for feminine than masculine nouns. Although it is possible that Experiment 1 had greater power for detecting such an effect, this finding is not so surprising if we consider that it had not been previously observed in Italian. Even in French, the language in which this effect appears to be most robust, it was reported for one experiment only (Vigliocco & Franck, 1999).

Finally, if we take the inanimate items as a further baseline to assess the impact of conceptual information in the context, our results again show that costs and benefits associated with the presence of congruent and incongruent conceptual information are nonsymmetrical, in a manner parallel to our comparisons of the context and no-context conditions in Experiments 1–4.

In the discussion of Experiments 3 and 4, we speculated that one possible reason for this asymmetry might be that even when preambles are presented without a context, participants may develop discourse models of the materials including a main character whose sex might be determined on the basis of the epicene’s gender. Such a hypothesis does not hold for the current study. Here the baseline involves nouns referring to inanimate entities for which gender is not
conceptually motivated. However, we still observe an asymmetry such that costs of having an incongruent referent are higher than benefits associated with having a congruent referent. This finding is compatible with the alternative hypothesis we outlined in the discussion of Experiments 3 and 4, according to which incongruent contexts exert an interfering effect.

**GENERAL DISCUSSION**

The main result of this series of studies is that syntactic accuracy (operationalized as agreement accuracy) was affected by the type of conceptual information regarding the sex of a referent. Similar results have been reported in two languages, indicating that the findings seem to generalize across Romance languages. These results suggest that conceptual and syntactic information are both used during encoding. They also indicate that discourse information is available and used beyond selecting the appropriate lexical entry (e.g., selecting “man” or “woman”) or the appropriate inflection (e.g., in “ragazzo” [boy] and “ragazza” [girl], in Italian) on the basis of the speaker’s intentions. Below, we discuss the interplay of syntactic and conceptual information and sketch how conceptual information may come into play during production. First, however, we address some other interesting findings from these experiments that are not directly related to the conceptual effects.

**Gender Mismatch Effects (or Lack of Effects) and Asymmetries between Masculine and Feminine Subject Head Nouns**

A finding consistently reported in both naturally occurring and experimentally induced agreement errors (both agreement in gender and in number) is the effect of a mismatching local noun (e.g., Bock, 1995). Although we replicated previous results in Experiments 3 and 4, we failed to observe a mismatch effect in Experiments 1 and 2. Experiments 1 and 2 differ from all other studies in the literature in that a sentential context was introduced, providing a more detailed discourse model for the sentence preamble. The presence of a more detailed discourse model may have increased the weight of conceptual information over syntactic information, overshadowing any syntactic interference from the gender mismatching local noun in the experimental situation.

In Experiments 1 to 4, we found an asymmetrical distribution of errors for subject head nouns with masculine and feminine gender. Whereas in French this result replicates previous studies (Vigliocco & Franck, 1999), such an effect has not previously been reported for Italian. Note, however, that for Italian, the effect was not significant in Experiment 5, although a trend in the direction of more errors for feminine than masculine head nouns was still present.

In Vigliocco and Franck (1999), we described the higher error rate for feminine nouns as a tendency to overuse the masculine form of adjectives. This can be considered the “unmarked” form, since it is used to refer to mixed groups of men and women when the sex of the referent is unknown and as the form of past participles (Greenberg, 1966; Tiersma, 1982). The tendency to overuse the unmarked masculine form of adjectives cannot be accounted for in terms of a tendency to use epicene nouns to refer to male entities because such an effect was significant even when stereotypical gender effects were partialled out in the covariate analysis.

As discussed in Vigliocco and Franck (1999), a puzzle arises when we compare the findings for number agreement errors and the findings reported here for gender agreement errors. The masculine form of nouns may be considered as the unmarked form in Italian and French, since it is the form used for nouns with conceptual gender (such as *ragazzo* [boy], in Italian) to refer to a “generic” young person and it is the form used to refer in the plural (*ragazzi*, boys) to a mixed group of boys and girls. The asymmetrical distribution of errors in number agreement reported in a variety of languages has been explained by assuming that the unmarked form of the subject noun is the one most affected from interference by a local (marked) noun. The same reasoning does not apply for gender, since errors are more common for feminine subject head nouns, i.e., the marked form. The asymmetric error distribution for number and gender agreement errors presents a contrast. For number agreement er-
rors the asymmetry between singular and plural subject head nouns comes about only in the context of a number mismatching local modifier. For gender agreement errors, the asymmetry between masculine and feminine head nouns is also found when the local modifier matches the gender of the subject head noun. This difference renders our description of the asymmetry between masculine and feminine head nouns in terms of a tendency to use the unmarked form of an adjective (instead of in terms of interference from a marked local noun) plausible.

Accuracy: The Role of Conceptual Information

According to the maximalist hypothesis, the grammatical encoder takes all of the information available from conceptual structures. This leads to an advantage when such conceptual information is congruent and to a cost when it is incongruent. Previous studies have shown detrimental effects in subject–verb agreement (e.g., Vigliocco, Hartsuiker et al., 1996) and benefits in subject–predicative adjective agreement (Vigliocco & Franck, 1999). Here, we have shown costs and benefits in subject–predicative adjective agreement for the same items depending on the conceptual information available in the discourse model.

An interesting result from our experiments is that these costs and benefits are nonsymmetrical. The cost associated with having an incongruent referent is greater than the benefit associated with having a congruent referent. This was the case using two different types of materials as baselines: the same items with epicene nouns as head nouns but without a context and unrelated items with inanimate head nouns. In the discussion of Experiments 3 and 4, we speculated that with epicene nouns, speakers might use the syntactic gender of the noun as a cue to the sex of the referent in building an interpretation that guides production. Although this may be the case to some extent, it cannot explain why such an asymmetry was also found in Experiment 5, where the baseline comprised inanimate nouns. A more likely possibility is that this asymmetry may come about because, while both congruent and incongruent conceptual information can be used if the syntactic information is lost, only incongruent conceptual information would exert an interfering effect on the (primary) syntactic information in addition. A word of caution is necessary however. The use of the inanimate items in Experiment 5 as a baseline to assess costs and benefits was post hoc, since the main focus of the experiment was to assess the role of syntactic congruence between the noun in the context and the head noun and to assess the role of morphophonological marking of the proper nouns. Furthermore, in this experiment, the difference between the congruent context condition and the baseline was only marginally significant, probably because of a lack of power (although the difference between these two cases (1.7%) was of the same order of magnitude as the difference between nouns with conceptual gender and nouns with grammatical gender (2%) reported by Vigliocco & Franck, 1999).

Our results help explain how syntactic accuracy is achieved. The use of additional and unnecessary conceptual information may protect against information loss, or more generally strengthen the syntactic information. This is contrary to the idea of a strict separation of labor between conceptual and syntactic encoding to ensure that unnecessary information does not interfere. Such a redundancy in the system is useful since, in general, conceptual and syntactic information are congruent. Incongruency can be considered more as an exception in Romance languages, and probably more generally in Indo-European languages. For gender, the majority of nouns referring to humans have their gender determined on the basis of the sex of the referent (more than 90% in our estimate for Italian and French). Nouns that refer to both sexes are rare (and the nouns used in the present experiments are an almost exhaustive list). Furthermore, as professions previously considered typical for men have become more popular among women and vice versa, these languages changed (and continue to change) the gender of the nouns accordingly, creating new feminine equivalents of masculine nouns (e.g., senatore/senatrice, sénateur/sénatrice [senator, masculine and feminine]) and vice versa.

What are the implications of the hypothesis of maximal input for grammatical encoding? We
maintain a levels of integration approach to sentence production, in which conceptual information (e.g., the sex of a referent) is specified at a conceptual level, while syntactic information (e.g., the gender of a noun) is specified at a subsequent level (during grammatical encoding, Bock & Levelt, 1994; or functional level processes, Garrett, 1975) associated with lexical representations. Agreement can be considered to be one of the processes occurring during grammatical encoding as part of phrasal integration. It occurs before word-order relations are worked out and therefore is determined on the basis of a hierarchically organized sentential frame (Bock & Cutting, 1992; Franck, Vigliocco & Nicol, submitted; Vigliocco & Nicol, 1998). Vigliocco and Franck (1999) discuss two possible mechanisms by which conceptual information may take part in the process of phrasal integration. In one view, conceptual information plays a role in determining the strength of the syntactic marking of the subject head noun (the agreement controller). In the other view, conceptual information directly influences the marking of the predicative adjective (the agreement target). In that article, we argued for the second account on the basis of previous findings concerning number agreement in which the conceptual effect arose as a phrasal, rather than lexical effect (see Vigliocco & Franck, 1999, pp. 475–476). Either way, our experiments support a position in which conceptual information exerts a fine-grained influence on grammatical encoding, an influence that goes beyond the initial stages of lexical selection.

Our data do not speak to the issue of whether information from the level of grammatical encoding feeds back to the level of conceptual encoding. That is, by themselves they cannot be taken to support an interactive view of conceptual to grammatical mappings. However, some lines of argument can be taken to support interaction between these two levels in sentence production. A first line of argument concerns language variability. Bidirectional flow of information between conceptual and grammatical encoding might be necessary to ensure that those aspects of the syntactic form that need to be encoded in a language are, in fact, available in the conceptual representation developed by the speaker. This fact is captured by the thinking for speaking hypothesis put forward by Slobin (1996), according to which speakers of different languages may encode different information in conceptual-level representations. This is not, however, strong evidence for bidirectional flow of information in adult language use. In fact, Levelt (1989) suggested that these language-specific requirements may imply that “although conceptualizing and grammatical encoding are interacting for the language-acquiring child, the mature speaker has learned what to encode when preparing a message for expression. (. . .) In short, the systems have become autonomous” (p. 105). This line of argument against bidirectionality hinges on the assumption of discontinuity between learning a native language and using it as an adult, an assumption that has been questioned (see Seidenberg & McDonald, 1999). A second line of argument concerns the assumption of shared lexicosemantic representations (i.e., lemmas) in production and comprehension (Levelt, 1989). If coupled with a lexicalist view of syntactic processing in both production and comprehension (according to which syntactic information is represented in terms of lexical frames stored in the lexicon associated with the corresponding lemmas: Kempen, in preparation; McDonald et al., 1994; Vosse & Kempen, 2000), this suggests a certain degree of interaction between conceptual and grammatical encoding by virtue of the fact that the same representations are used for encoding and decoding.

The Interplay of Conceptual and Syntactic Information

To say that the language production system uses conceptual information when available to ensure accuracy is not to say that only conceptual information is used. If this were the case, gender agreement would always be with the sex of the referent regardless of the gender of the noun. This is clearly not true. First, as mentioned above, for epicene nouns, subject–predicative adjective agreement is with the syntactic gender of the noun, regardless of the sex of the referent. Second, although we found a substan-
tial number of errors in Experiments 1 and 2 when the sex of the referent and the gender of the noun were incongruent, in the majority of cases (84% in Italian and 77% in French) agreement was correctly computed with the grammatical gender of the nouns. In other words, as discussed in the introduction, syntactic information is the primary source of information in subject–predicative adjective agreement, while conceptual information is a secondary source.

For epicene nouns, classification of sources of information as “primary” or “secondary” differs depending upon the agreement relationship under consideration. For these words, agreement between the subject and an anaphoric pronoun can be either syntactic or conceptual. That is, both sentences (11) and (12) are acceptable in Italian when referring to a man:

(11) La vittima sosteneva che lo avrebbero dovuto rimborsare . . .
   The-fem victim-fem maintained that he should-masc be reimbursed . . .

(12) La vittima sosteneva che la avrebbero dovuta rimborsare . . .
   The-fem victim-fem maintained that she should-fem be reimbursed . . .

Hence, when we consider subject–anaphoric pronoun agreement, syntactic information cannot be considered primary. However, all of the studies that have addressed subject–anaphoric pronoun agreement in languages such as Dutch, French, Italian, and Spanish, either in production (Meyer & Bock, 1999) or in comprehension (Garnham, Oakhill, Ehrlich, & Carreiras, 1995; Cacciari et al., 1997), have reported a role of syntactic information. Even if subject–anaphoric pronoun agreement is more susceptible to conceptual features, grammatical gender still exerts a separable effect on processing.

The observation that different types of agreement relationship may use syntactic and/or conceptual information has been described by Comrie (1975) and Corbett (1983) in terms of an agreement hierarchy. In this view, there are four main types of agreement targets: attributes, predicates, relative pronouns, and personal pronouns (Corbett, 1983). In moving rightward along this hierarchy, the likelihood of observing conceptual instead of syntactic agreement increases (see also Vigliocco, Butterworth, & Garrett, 1996). Such a difference in terms of the role of syntactic and conceptual information in agreement processes for different types of agreement relations has also been reported for number agreement in American English. Bock, Nicol, and Cutting (1999) showed that plural agreement with collective nouns (e.g., cast, referring to actors) was more common for subject–pronoun agreement than for subject–verb agreement.

The next important question is, therefore, what determines when conceptual information is only a secondary source of information and when, it plays a primary role. The agreement hierarchy emphasizes that a fundamental factor in determining whether syntactic information is a primary source is the type of agreement target (and therefore the type of agreement relation). In processing terms, however, moving from subject–predicative adjective agreement to subject–pronoun agreement also implies crossing clause boundaries (i.e., changing the encoding domain) and further implies a greater processing distance between the two agreeing elements. Regarding the domain, Bock and colleagues (Bock et al., 1999) have found that the likelihood of observing conceptual agreement for collective nouns did not differ between reflexive pronouns [clause internal, sentence (13)] and tag pronouns [clause external, sentence (14)], suggesting that it does not matter whether the agreement target is clause internal or external:

(13) The cast in the soap opera watched (itself/themselves).
(14) The cast in the soap opera rehearsed (didn’t it/they).

Regarding the role of processing distance (which can be operationalized in terms of number of words or constituents intervening between the agreement controller and the agreement target), we have investigated whether increasing processing distance increases the likelihood of observing conceptual agreement (Vigliocco, Franck, Collina, & New, 2000). Using materials similar to those used in Exper-
iments 1 and 2, we increased processing distance by introducing an adjective in the modifying noun phrase or by introducing an additional modifier prepositional phrase. Processing distance increased the occurrence of agreement errors. Crucially, however, increasing processing distance did not affect the likelihood of observing conceptual instead of grammatical agreement. These results suggest that the type of agreement relationship may be the factor underlying the agreement hierarchy, at least from the speakers’ perspective. From the readers’ perspective, interestingly, Garnham et al. (1995) showed that processing distance affected the time to detect the antecedent of the anaphoric pronoun in French. They reported a significant interaction in reading times between the distance and the type of gender of the antecedent (conceptual vs grammatical).

CONCLUSION

We have contrasted two general views concerning the interplay of syntactic and conceptual information during language production. These two views account for accuracy in different ways and make different predictions about whether nonsyntactic factors can affect grammatical encoding. Our results falsify the minimalist view, which assumes a strict division of labor between conceptual preparation and grammatical encoding. Rather, the results support the maximalist view, according to which nonsyntactic conceptual information is directly implicated in the mechanisms of phrasal integration. The findings are compatible with the hypothesis that different types of information are used to a different extent depending upon the type of dependency under consideration.

REFERENCES


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